

REMARKS

This is in response to the Office Action dated September 24, 2003. Claims 1-8 and 15-20 are pending.

Section 112 Rejection

Claims 1-8 and 15-20 stand rejected under 35 U.S.C. Section 112, first paragraph. The Office Action contends that the roughened surface being "exposed to surrounding atmosphere" is not described in the application as filed. This Section 112 rejection is respectfully traversed for at least the following reasons.

The roughened surface exposed to surrounding atmosphere is clearly shown in the figures of the instant application, and is explained in the specification. For example, in Figs. 2A and 2B, light scattering layer 9 has a roughened surface that is exposed (e.g., pg. 18, line 19 to pg. 19, line 1). Moreover, the application at pg. 19, lines 6-9 that the surface of the overall semiconductor device is roughened. Because layer 9 is the only roughened surface in the Fig. 2 embodiment, this statement that the surface of the overall semiconductor device is roughened can only mean that layer 9 is at least partially at the surface of the overall device. See also Figs. 6A and 6B which illustrate current diffusion layer 27 whose roughened surface by abrading is exposed (pg. 21, line 24 to pg. 22, line 2), and Figs. 10A-10B which illustrate current diffusion layer 51 whose roughened surface by etching with HCl is exposed (pg. 26, lines 15-18), and so on.

Furthermore, the specification states at pg. 4, lines 1-6 that the surface of the overall device is roughened. Again, since the surface of the overall device is exposed to

surrounding atmosphere, the claimed subject matter is clearly supported by the specification as filed.

In view of the above, since the claimed subject matter is supported by the application as filed, it is respectfully requested that the Section 112 rejection be withdrawn.

Claim 1 -- Section 103(a) Art Rejection

Claim 1 stands rejected under 35 U.S.C. Section 103(a) as being allegedly unpatentable over Krames in view of Saeki and Vakhshoori. This 3-way Section 103(a) rejection is respectfully traversed for at least the following reasons.

Claim 1 as amended requires "a DBR (Distributed Bragg Reflector) and a light-emitting layer supported by at least a substrate comprising GaAs, the DBR being located between the substrate comprising GaAs and the light-emitting layer, wherein light directed from the light-emitting layer toward a top surface of the light-emitting device has a radiation angle dependence; a semiconductor layer formed over at least the light-emitting layer, a top surface of the semiconductor layer comprising a roughened surface which is at least partially uncovered and exposed to surrounding atmosphere in order to cause light output from the light-emitting device to be diffused upon leaving the top surface of the device; and wherein no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened."

Vakhshoori is entirely unrelated to the invention of claim 1. In particular, claim 1 as amended requires that the top surface of the semiconductor layer is at least partially

roughened in a manner which causes "light output from the light-emitting device to be diffused upon leaving the top surface of the device." Vakhshoori teaches the opposite of claim 1 in this respect. Instead of causing output light to be diffused as called for in claim 1, Vakhshoori uses a type of roughness for the express purpose of causing output light to be focused (see Fig. 2; col. 1, lines 50-55; and col. 3, line 55). Thus, it can be seen that Vakhshoori teaches direction away from the invention of amended claim 1 and is unrelated to the same.

Krames is also unrelated to the invention of amended claim 1. In particular, claim 1 requires that "no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened." Krames fails to disclose or suggest this aspect of claim 1. Fig. 13 of Krames sandwiches a light emitting layer 2 between a pair of DBRs. Fig. 14 of Krames also requires a DBR 22 over the light emitting layer 2. Thus, it can be seen that all DBR embodiments of Krames use at least one DBR located over the light emitting layer so as to be provided between the light emitting layer and an overlying layer with surface roughness. This requirement of Krames is the opposite of what claim 1 requires. Krames teaches directly away from the requirement of claim 1 that "no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened" and is entirely unrelated to claim 1 in at least this respect.

Saeki also is unrelated to amended claim 1. In particular, Saeki clearly fails to disclose or suggest the requirement of amended claim 1 that "a top surface of the

semiconductor layer comprising a roughened surface which is at least partially *uncovered and exposed to surrounding atmosphere* in order to cause light output from the light-emitting device to be diffused upon leaving the top surface of the device." Saeki teaches directly away from this aspect of claim 1, as Saeki requires many layers over top of the roughened portion in Fig. 8B.

The Final Rejection contends that it would have been obvious to leave out the top DBR of Krame's device, as allegedly taught by Saeki. This contention made in the Final Rejection is respectfully traversed. In Krame's Fig. 13, there is disclosed an RC (resonant cavity) LED. In this type of LED, the active layer is positioned within a small vertical cavity defined by the pair of sandwiching reflecting DBRs (mirrors) (col. 6, lines 6-16 of Krames; or http://photonics.intec.rug.ac.be/download/pub_295.pdf). This means that an RCLED must have both an upper DBR and a lower DBR surrounding the active layer to function properly. Thus, it can be seen that one of ordinary skill in the art would never have removed Krame's top DBR as alleged in the Final Rejection because to do so would destroy the RCLED with respect to purpose and functionality.

In contrast to RCLEDs, claim 1 expressly excludes RCLEDs by stating that "no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened." In other words, the device of claim 1 has no upper DBR, and functions quite differently from Krame's RCLED. Thus, one of ordinary skill in the art would never make an RCLED as in Krame without a top DBR as alleged in the Office Action, because removal of the top DBR would destroy the RCLED itself.

With respect to the Examiner's contention that Vakshoori has a mirror function obtained by a single layer, this is incorrect. While a n+ AlGaAs mirror is disclosed by Vakshoori at col. 3, line 4, a p-type AlGaAs upper mirror is also disclosed at col. 3, line 8. Thus, in direct contrast to the Examiner's unsupported allegation, the mirror function in Vakshoori is achieved by a pair of mirrors – not a single mirror. Again, the very basis of the Section 103(a) rejection is incorrect. The Section 103(a) rejection should be withdrawn for this additional reason as well.

Claim 15 - - Section 103(a) Art Rejection

Claim 15 states that "a roughened surface which is at least partially uncovered and exposed in order to cause light output from the light-emitting device to be diffused upon leaving the top surface of the device; and wherein no DBR is provided between the light-emitting layer and the semiconductor layer having the top surface that is roughened."

The cited art fails to disclose or suggest these aspects of amended claim 15.

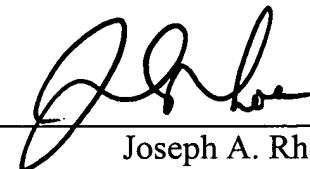
Conclusion

For at least the foregoing reasons, it is respectfully requested that all rejections be withdrawn. All claims are in condition for allowance. If any minor matter remains to be resolved, the Examiner is invited to telephone the undersigned with regard to the same.

KURAHASHI et al.
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Respectfully submitted,

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